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**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Order Instituting Rulemaking to Oversee
the Resource Adequacy Program, Consider
Program Refinements, and Establish Forward
Resource Adequacy Procurement Obligations.

Rulemaking 19-11-009
(Filed November 7, 2019)

**REVISED TRACK 3B.2 PROPOSALS OF
PACIFIC GAS AND ELECTRIC COMPANY (U 39 E)**

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Dated: December 18, 2020

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I. INTRODUCTION

On December 11, 2020, Assigned Commissioner Liane M. Randolph issued the *Assigned Commissioner’s Amended Track 3B and Track 4 Scoping Memo and Ruling* (“Amended Scoping Memo”). The Amended Scoping Memo modifies the previous schedule for Track 3B of this proceeding, bifurcating it into two tracks: Track 3B.1 and Track 3B.2. The following issues are now designated as Track 3B.2 issues, with revised Track 3B.2 proposals due on December 18, 2020:

1. Examination of the broader RA capacity structure to address energy attributes and hourly capacity requirements, given the increasing penetration of use-limited resources, greater reliance on preferred resources, rolling off of a significant amount of long-term tolling contracts held by utilities, and material increases in energy and capacity prices experienced in California over the past years.
 - a. Specifically, address the direction the Commission intends to move in with respect to larger structural changes (e.g., capacity construct addressing energy attributes and reliance on resource use-limitations, forward energy requirement construct). Set forth the necessary milestones and additional details that must be determined in order to implement the adopted direction for a compliance year no earlier than 2023.
 - b. Multi-year system and flexible RA requirements, as stated in D.20-06-002.¹

The Amended Scoping Memo invites parties to provide revised proposals on these Track 3B.2 issues, as well as comments on the Track 3B.2 schedule and process.²

¹ Amended Scoping Memo, pp. 4-5.

² *Id.*, pp. 5-6.

Pursuant to the schedule set forth in the Amended Scoping Memo, and in accordance with the Rules of Practice and Procedure of the California Public Utilities Commission (“Commission”), Pacific Gas and Electric Company (“PG&E”) hereby submits revised proposals regarding Track 3B.2 issues (“Proposals”). PG&E’s revised Proposals are set forth in Attachment 1 hereto.

II. CONCLUSION

PG&E appreciates the opportunity to provide its revised Proposals on Track 3B.2 issues. PG&E looks forward to working with the Commission and stakeholders to further develop and explore the revised Proposals and other Track 3B.2 proposals.

Respectfully Submitted,

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Dated: December 18, 2020

Attachment 1
to
REVISED TRACK 3B.2 PROPOSALS OF PACIFIC GAS AND ELECTRIC COMPANY
(U 39 E)

PG&E Revised Proposals on Track 3B.2 Issues in Rulemaking 19-11-009

Prepared by:

Luke Nickerman and Peter Griffes.

PG&E Revised Proposals on Track 3B.2 Issues in Rulemaking 19-11-009

PG&E's revised Proposals in Track 3B.2 of Rulemaking 19-11-009 are set forth below. Section I below presents PG&E's slice-of-day proposal. Section II below presents PG&E's contract hedge proposal.

I. PG&E'S SLICE-OF-DAY PROPOSAL

1. Background

The current resource adequacy ("RA") program is primarily based on meeting the electric system's gross peak demand for a given month of the year. The RA program translates these gross peaks into monthly showing requirements for individual load serving entities ("LSE") to meet capacity needs in any given hour of the given month. The RA program was developed in 2004 – at a time when most generation resources were available on a continuous basis since there was a steady fuel supply, namely, natural gas. The assumption was having enough capacity to meet monthly gross peak demand with continuously available resources would ensure sufficient capacity to meet the gross energy demand in any other period.

Since the development of the RA program, there has been tremendous growth in fuel-limited resources, particularly renewables like wind and solar resources. This growth has been a positive development toward meeting California's greenhouse-gas ("GHG") reduction goals. However, the variable delivery and non-dispatchability create reliability planning challenges. These challenges have spurred the adoption of energy storage resources, which can move energy to other time periods of the day.

With the current focus of RA on a subset of hours in the day, namely around the gross peak demand, it made sense to move energy from hours of excess to hours of need. With the current levels of energy storage capacity on the system, energy storage has been viewed and counted in the RA paradigm like dependable gas-fired resources – based on their maximum output over a consecutive four-hour period. However, energy storage resources have significant operational limitations and, at increasing levels, could present new reliability challenges. Energy storage resources do not produce energy by changing fuel into electricity, but rather consume energy in one time period to produce energy in another time period. At scale, this consumption of electricity

during charging could present challenges in periods that previously were not a concern if there are no rules to ensure the charging of energy storage resources does not happen all at once or that sufficient energy is available for the charging.

With the increasing reliance on fuel-limited resources, like wind and solar resources, and the forecasted growth of energy shifting resources, like energy storage, it is not clear that the logic that underpins the current RA program is sufficient or sustainable to maintain reliability going forward. For example, the current RA program has monthly requirements based on the gross peak demand of that month and all resources are expected to be available to produce in all hours of the month. The increasing growth of fuel-limited resources, which are generally preferred due to their GHG reduction purposes, is challenging a system that was not built for the current and future resource mix. For example, solar resources are not able to produce during the gross peak hours of demand in the winter. Notably, the current operational problems center on the net peak demand, as demonstrated by the August 2020 blackouts.³ However, limiting changes only to the net peak demand would fail to recognize the broader shift that is underway and that could lead to problems in other hours of the day.

Consequently, the RA program should be modified to address the limitations of the current and future resource mix. The focus of these changes should be on meeting demand in all hours of the day with resources that are able to produce during particular hours and adequately adopting RA counting methodologies that accurately measure all resource contributions for being able to meet demand in the particular hours they are being relied upon to meet demand. For example, solar resources should only be counted on to produce when the sun is expected to shine. The discussion below outlines an approach to RA requirements based on a ‘slice-of-day’ concept in which there are showing requirements for each slice-of-day and resource RA counting reflects the individual resource’s ability to produce energy during each respective slice. To offset the

³ See California Independent System Operator Corporation, California Public Utilities Commission, California Energy Commission. (October 6, 2020). *Preliminary Root Cause Analysis: Mid-August 2020 Heat Storm*, Figure ES.2 (Demand and Net Demand for August 14 and 15).

administrative burden of adding more showing periods, PG&E recommends moving to seasonal RA obligations. While much analytical work needs to be done to translate this approach into concrete requirements, it is not difficult to outline the type of analysis and considerations that must be made to establish such requirements, which are discussed further below.

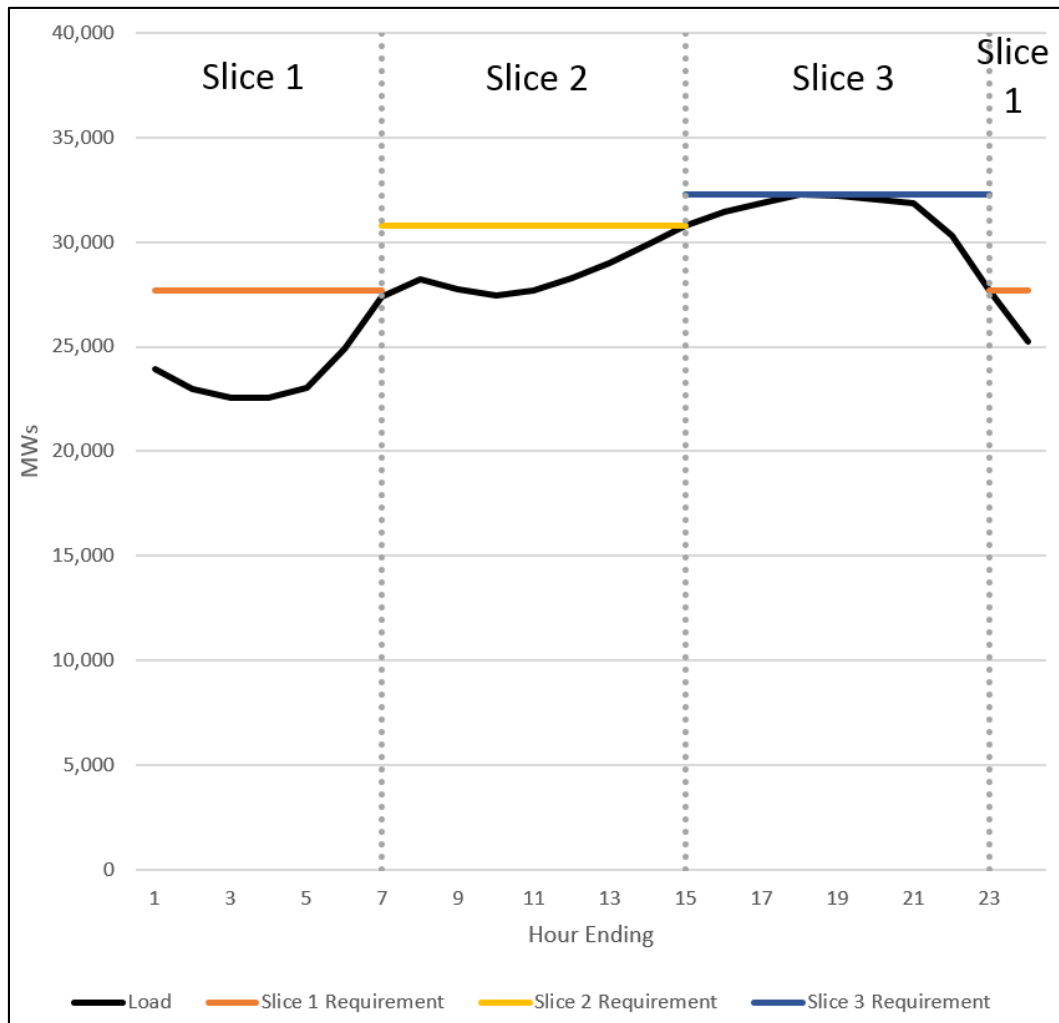
2. Summary of PG&E's Proposal

a. What Problem is Being Solved?

The RA program needs to facilitate resources with limited availability during the day to meet demand in all hours of the day with limited expansion of the administrative burden of more showing periods. To further demonstrate the slice-of-day proposal and how it would work, PG&E provides the following example below.

For a given load shape for a showing period (perhaps seasonal), the day would be divided into several slices of periods, in this case three periods. These periods could be defined as 11 p.m. to 7 a.m.(night), 7 a.m. to 3:00 p.m.(morning), and 3:00 p.m. to 11:00 p.m.(evening) as illustrated in Figure 1. This would effectively result in an RA showing requirement for each slice-of-day (Slice 1, Slice 2, and Slice 3) for each season. The RA showing requirements would be based on some level of demand in each slice for the season as illustrated in Figure 1.

Figure 1: Illustrative Load Curve

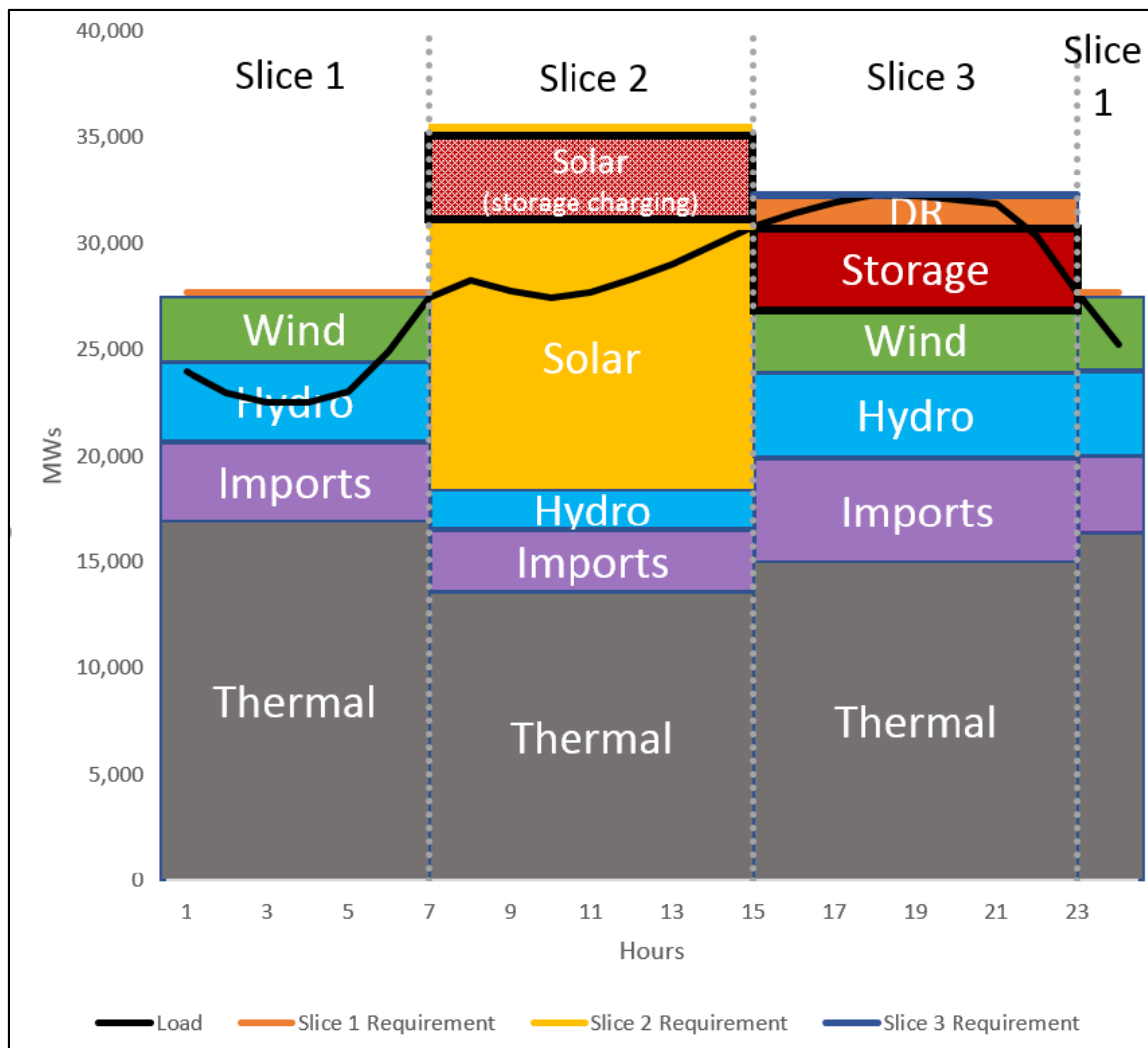


Accordingly, the amount that each resource could count towards each slice-of-day (Slice 1, Slice 2 and Slice 3) requirement would be dependent on the resource's ability to produce during that particular slice-of-day. For example, a gas-fired resource with no use-limitations could count in all slices of the day, as could imported resources if they are willing to be available in all slices of the day. However, a solar resource would not be able to produce energy during the "night" slice-of-day (Slice 1) and could not count towards meeting the RA requirements in that slice of the day. Similarly, other resources with limited availability, like demand response ("DR"), could

choose which slice-of-day they would be available for, and count for RA within those slices. This can be seen in Figure 2. Given the unique operational characteristics of energy storage resources, these resources would be able to count in Slice 3, but it would also carry the obligation to count negatively in periods that it would be charging (e.g. Slice 1 or Slice 2). Under this type of framework, the RA program would be able to ensure load could be met in all hours of the day, not just during the gross peak demand hours, and there is sufficient energy on the system to charge energy storage resources.

Figure 2 illustrates how resources could be stacked in each slice-of-day to meet the RA requirements in each period. For example, in Slice 1, thermal, hydroelectric, imports and wind resources are all committed to being available to meet demand from 11 p.m. to 7 a.m. In addition to the mix of resources to meet Slice 1 requirements, Slice 3 adds both energy storage and DR resources. However, because energy storage does not have an independent source of energy, it must designate when it plans to charge to be able to count in Slice 3. In Figure 2, energy storage commits to charging during Slice 2 when the sun is shining and there is potential for “excess” energy to inject into the energy storage device. The need for energy storage charging subsequently increases the RA requirement in Slice 2 since there must be enough capacity committed to meeting demand and charging energy storage. This is represented in Figure 2 by the lighter red stack in Slice 2. Notice that the overall RA requirement is higher in Slice 2 than in Slice 3. This is because there needs to be enough resources on the system committed to charge energy storage, which will be used to meet demand in the later slice-of-day period.

Figure 2: Illustrative RA Requirements and Resources to Meet those Requirements



Figures 1 and 2 illustrate the basics of PG&E's proposed slice-of-day framework. Additional work is required to put the framework into place, including determining the number and length of the slices-of-day as well as the number and duration of seasons. The determination of these aspects needs to account for variations in load shapes, but also variation in resource availability as well.

A summary of the changes that are likely required are included in Table 1 below and elaborated on in the sections that follow.

Table 1: Summary of Today’s RA Framework v. “Slice of Day” Framework

	Today	“Slice of Day”
RA Showing Requirements	Gross peak hour; annual and monthly	Peak hour in each slice of day; seasonal
Establishment of Requirements	Top down based on forecasted peak load	Top down or bottoms up based on forecasted peak load in each slice
Resource Counting	Resource dependent (PMax, Exceedance, ELCC)	Exceedance
Must-Offer-Obligation (MOO)	For all hours	Only during slice for which resource is shown
RA Requirements Related to Energy Storage Charging	None	LSE is obligated to show capacity to meet charging needs

b. How are the System Requirements Being Set?

Total system requirements are set on a slice-of-day basis for each showing period, based on the maximum level of demand for the particular slice-of-day for the showing period. While this structure does not *a priori* establish the number or duration of the slices of the day, it will need to be determined. In such determination, a balance needs to be achieved between the length of the slice-of-day and the number of slices per day. More slices per day increases the showing and administrative burden, however, longer slices of the day means more averaging across the hours within the slice, and the more likely the values calculated for the slice will deviate from values in individual hours. The slice definition will have particular importance for energy storage resources which are likely to have much greater variation in output, particularly for short-duration energy storage resources which are currently entering the resource mix. Candidate periods are: (A) six four-hour slices or (B) four six-hour slices.

Seasonal periods will also have to be set in conjunction with the number of slices per day, largely to address administrative burden for the showing requirements. As with slices of the day,

fewer showing periods reduces administrative burden, but increases the variation within the showing period, leading to greater inaccuracy. If seasonal periods were set to minimize the variation in solar output in each of the seasons for each slice-of-day, candidate periods could be compromised of three consecutive months with: Spring (February, March, and April), Summer (May, June, and July), Autumn (August, September, and October), and Winter (November, December, and January).⁴ Additional analytical work needs to be done to establish the showing periods and should be done in conjunction with setting the duration of the slices per day. A planning reserve margin could also be added to the requirements in each slice-of-day to account for load uncertainty, operating reserves, and forced outages of resources.

c. How do Resources Count for Meeting the Requirement?

(1) Background

Under the current RA system, there are many different methodologies for counting how a resource contributes to reliability, largely dependent on the technology of the resource and its capability. On-demand resources are based on the maximum output that they can sustain for four consecutive hours, which is often the maximum output of the resource. Energy storage resources' RA values are also based on maximum output that they can sustain for four consecutive hours. Per direction from the Legislature, the Commission has adopted an Electric Load Carrying Capability ("ELCC") methodology for solar and wind resources. Hydroelectric resource RA counting rules are based on an exceedance-based approach and include higher weighting on low-hydroelectric years. The Commission uses load-impact-protocols for RA value for the contribution of demand response.

There have also been changes in the RA counting methodologies over time. For example, before adopting an ELCC approach, solar and wind resources were based on an exceedance-based methodology. An ELCC-based methodology has also been adjusted over time as the calculation

⁴ For example, with four seasons and three slices-of-the-day, only 12 RA showings would be required on an annual basis. This is in comparison to the 13 RA showings that are currently required on an annual basis (1 annual and 12 monthly).

methodology is strongly influenced by aggregate generation mix included in the analysis. There are currently proposals to change the counting for a few different resource types, including demand response and hybrid and co-located resources.⁵

(2) Exceedance-Based Methodology for RA Counting

If a resource's ability to produce energy varies over the slice-of-day, then the amount that resource should be counted on to meet load during that particular slice-of-day should reflect its ability to do so. Consequently, resource counting for a use-limited resource will need to be calculated based on its ability to produce energy at the time it is needed. This is certainly the case for several types of resources, including solar, wind, and energy storage resources.

For the proposed slice-of-day approach to RA, PG&E proposes to use an exceedance-based methodology to determine how resources can count toward meeting the particular slice-of-day RA requirements in each showing period. This is to simplify the process for determining qualifying capacity values across multiple time periods and more accurately represent some resources. This approach should be applied to all resource types, including solar and wind resources.

Much of the emerging challenges with the RA program are that use-limited resources are not evenly available across all hours of the day. For example, energy storage resources need time (and energy) to charge to be available to discharge when needed. Similarly, solar resource output is highly dependent on a shining sun. The current ELCC counting methodology undercounts the output of solar during day-light hours and overcounts its output during non-daylight hours. By moving to a slice-of-day type of framework, resource use-limitations are better matched to the obligations of providing energy to the system at times when they have the ability to do so.

Further, RA counting rules would also be applied on a resource-by-resource basis which would allow greater accuracy regarding a particular resource's contribution to reliability. Consequently, solar and wind resources, for which current capacity contribution is based on an aggregated portfolio mix, would instead be calculated at the individual resource level.

⁵ See Amended Scoping Memo, p. 8.

An exceedance-based methodology would also apply to traditional fossil resources, as their ability to produce energy at times may be impeded by weather conditions. High ambient temperatures reduce the ability of gas-fired resources to operate at full output, and, at such times when temperatures are likely to be high, the system should not count on the full production capability of the resource.

(3) Energy Storage Charging

The ability of some resources to produce is not only constrained by the fuel source, but also by the discretion of the resource operator. This is particularly true for energy storage resources that can charge or discharge at any period of the day, with the operational restriction that they need to be charged before they can discharge.⁶ For the California Independent System Operator Corporation (“CAISO”) to depend on these resources to produce energy at specific times of the day, it is necessary that the resource operator charge the energy storage resource prior to the discharge. It is also necessary for the operation to pre-commit to operating the resource in the timeframe specified for which it is being counted on to meet load conditions. The size and technology of an energy storage device will dictate how much energy it can deliver. However, the resource owner also has discretion over when it will deliver energy. In other words, the counting of energy storage resources for meeting load at particular times of the day requires the resource operator to commit to operating the resource in a way that will ensure delivery in those hours. For example, a 4-hour battery with 10 megawatts (“MW”) of capacity could count for one four-hour slice-of-day at 10 MWs. It may also be able to count for 5 MWs for two four-hour slices-of-day. However, there would be particular times of the day it could not count towards RA requirements, such as two consecutive four-hour slices at 10 MWs. The pre-commitment is necessary to ensure that the resource will be able to meet load needs in the slices-of-day that it is being counted on to provide energy.

⁶ Note that this section is primarily focused on short-duration battery storage. Other types of storage that can “charge” over many days or weeks and, thus, would not be limited by daily cycling, like pumped hydroelectric, should be treated differently.

Increased adoption of energy storage also presents the issue of where the energy will come from for the resource to move to the appropriate slice-of-day. Currently, hybrid and co-located resources explicitly will have energy coming from accompanying generation sources. Under the current RA counting rules, the provision of this energy to the energy storage device reduces the ability of the source generation to meet load and is counted less. However, there is currently no requirement for standalone energy storage capacity to designate their source of energy for charging; they are allowed to simply buy energy from the CAISO market, and it is unclear whether the CAISO market demand forecasts adequately account for such charging in these periods when it occurs. While energy storage capacity adoption has been small, there is little need to adequately account for charging in the load forecast. However, as energy storage capacity becomes a larger portion of the total resource mix and sources of energy are further reduced, it will become necessary to account for the capacity that will create the energy to charge the energy storage device. This energy obligation should fall to the LSEs that are contracting for energy storage to provide capacity.

d. How are Responsibilities Allocated to LSEs?

PG&E's proposed slice-of-day framework is best accommodated by a bottoms-up determination of each individual LSE's RA requirement. These requirements would be for each slice-of-day for each season. The bottoms-up approach would be based on the individual LSE's load shape for the year divided into the appropriate slice-of-day and showing period. It would also be dependent on any energy storage resources the LSE chooses to procure to meet any of its RA obligations in any slice-of-day period. As just described, energy storage is not a source of energy, but rather consumes energy, and there is a need to ensure not only whether there is sufficient capacity to meet load, but also whether there is sufficient energy to charge energy storage resources. This means capacity in one period could be used to charge energy storage for use in subsequent periods. Thus, an LSE's obligation would need to be augmented by capacity required to charge energy storage that would be used to meet the LSE's requirements in subsequent slices-of-day. LSE-level RA requirements would then have to be aggregated and checked against the

estimate of the total system RA requirements, with adjustments being made if necessary.

Alternatively, a top-down approach would take the system load shape and determine the system requirement in each slice-of-day for each showing period. The total requirement would then be able to be allocated to individual LSEs based on total load in each of the showing periods, either on a peak load in slice-of-day period or total energy consumed in each slice-of-day basis. However, this would require any energy storage used in any slice-of-day to be paired with capacity in earlier periods that would produce the energy to be stored and would only be accommodated by a requirement for energy storage to pair with capacity that produces energy to count to meet RA obligations.

Because the requirements would be set by each LSE's level of load in each slice-of-day, through either approach, there is a reduced ability for any LSE to lean on showings by other LSEs. Under both mechanisms, the LSE would have the incentive to move load from high-cost slices-of-day and to low cost slices-of-day.

e. What are the Requirements for RA Resources in the Energy Markets?

By counting for RA in a particular slice-of-day for a particular showing period, PG&E proposes that the resource has the obligation to bid that capacity into the CAISO's day-ahead and real-time markets daily during the hours of the slice-of-day for which it is counting for the entire showing period. For instance, a four-hour storage resource contracted for the evening hours would have a must-offer-obligation to bid into the market during that period. Combined with the pre-commitment described in the section above, the energy storage resource would also commit to charging during a specific slice-of-day. Lastly, the Commission may need to consider adopting operational constraints outlining how many slices-of-day resources can make themselves available for. This would ensure that resources that are not operationally able to perform a service do not contract for a service they are unable to provide and use market bidding strategies to ensure they are not called.

3. Further Analysis Needed

a. Energy Sufficiency

As noted above, PG&E's slice-of-day proposal sets out to address demand in all hours of the day. While the proposal does not go as far as hourly requirements, spreading RA requirements across multiple slices in a 24-hour period should help to address energy sufficiency concerns that have been emerging and are expected to continue. The smaller time periods should help ensure resources are available to meet load and, if structured appropriately, should provide greater certainty that load can be met in every hour. Notwithstanding the foregoing, energy sufficiency should still be tested while developing the particulars of the framework and periodically thereafter to ensure that the framework is meeting the intended goals of the RA program.

The framework is also flexible enough to add an energy forward component at a later date, if it is needed. An energy forward requirement would also need to be structured over several time periods to avoid administrative burden and thus could leverage this proposed framework.

b. Administrative Issues

This framework has the potential to increase the complexity and administrative burden of the RA program beyond where they are today. This proposal has trade-offs that simplify some aspects of the program but adds some level of complexity in others. Additional complexity for some aspects of the program is likely inevitable and requires evolving, as the nature of the resources on the grid are more presenting new challenges to manage than the non-use-limited and dispatchable resources that comprised the portfolio in the past. As a result, it is important that the Commission and other stakeholder recognize that additional resources are likely needed to ensure reliable operation of the grid in the future.

II. CONTRACT HEDGE PROPOSAL

A. Background:

Energy Division has indicated that it is concerned with the relationship between capacity markets and energy markets, as outlined in their initial proposal.⁷ In the past, RA showings were dominated by tolling arrangements where the buyer essentially assumed operation of the plant, being responsible for the procurement of fuel as well as participation in the energy markets as the scheduling coordinator. These arrangements, combined with a least-cost dispatch requirement by the Commission on the IOUs, ensured that generating suppliers contracted to the IOUs would bid at incremental production costs into the CAISO energy markets.

With the proliferation of LSEs over the last several years, not all of whom have the same level of experience in interacting with the CAISO on the selling side of the market, there has been much less of an appetite for tolling arrangements, particularly with the responsibilities that scheduling coordinators have at the CAISO.

PG&E offers the following proposal, which is designed to create an incentive for generators that sell RA to also bid into the CAISO energy markets at levels that produce an efficient market outcome. PG&E's proposal responds to Energy Division's options outlined in the August filing, that explored including a least-cost dispatch requirement or bid cap on RA contracts, as well as the options that explored changing RA requirements to forward energy showings instead of capacity showings.⁸ This proposal aims to achieve similar results, without going as far as a forward energy showing.

⁷ See *Administrative Law Judge's Ruling on Energy Division's Track 3.B Proposal*, dated August 7, 2020, Appendix A (Energy Division Issue Paper and Draft Straw Proposal for Consideration in Proceeding R.19-11-009, Track 3B, dated August 7, 2020), pp. 18-26.

⁸ *Id.*, pp. 38-39.

B. Proposal:

PG&E's proposal ties compensation for capacity to the unit's performance in the energy market, on an ex post basis. Variable operating costs for fossil-fired generators generally consist of fuel, variable operations and maintenance ("O&M") costs, and emissions costs. Therefore, the contract could identify the heat rate, variable O&M, and emissions costs upfront and require a rebate to the LSE of any energy market revenues that exceed these costs. If the generator does not participate in the CAISO market, or bids at levels higher than the specified contract price, it still has the obligation to rebate the contracted energy revenue back to the buyer. The Commission would require that RA showings conform to this type of contract in order to qualify for RA. By including these rebate requirements, the mechanism would provide an incentive for the generator to participate in the CAISO's energy market by bidding its costs.

This approach works well for natural gas units, but likely could also be applied to other types of resources. For instance, for energy storage resources, the contract could be based on the spread between the charging costs and discharging revenues. Approaches for other resources would need to be addressed in discussions with stakeholders.

C. Thermal Example:

To further demonstrate the contract hedge proposal and how it would work, PG&E provides the following example of a generator with a heat rate of 9,000 MMBtu/MWh and a variable O&M cost of \$5/MWh. With a fuel price of \$3.20/MMBtu and an emissions cost of \$1.00/MMBtu, the variable costs would be \$43/MWh. The resource should run when CAISO market prices are above this cost and should not run when the prices are below this cost. The relation of these costs to market prices can then be figured into the contract for capacity with the seller rebating a portion of what could be considered the unit's energy margin, $MW * (\text{Locational Marginal Price} - \text{specified variable cost})$, back to the seller when the Locational Marginal Prices

are above this level. Note that this is an illustrative example and specifics would need to be developed in conjunction with mechanisms for other resource types.

D. Transition:

Current central procurement entity (“CPE”) local RA requirements offer an opportunity to test this type of mechanism as Decision 20-06-002, which established CPEs for the PG&E and Southern California Edison Company distribution service areas, requires CPEs to include dispatch rights, or other means that stipulate how local resources bid into the energy markets, in their solicitations as an optional term that bidders are encouraged to include.⁹ Thus, the implementation of this CPE requirement could serve as a test case for how such a mechanism could work for the broader RA program.

⁹ Decision 20-06-002, Ordering Paragraph 8.e.